EARLY FELT FROM MOLES.

Lake Dwellers Used the Humble Animal's Hair to Make Cloth.

One of the interesting finds made by archæologists who investigated the remains of the European lake dwellers, people of prehistoric times that built their huts on piles over bodies of water, was the discovery of small quantities of what appeared to be fine wool cloth. Closer examination disclosed the fact that the fabric was not woven but was felted.

The scientists then began an investigation to discern what sort of an animal it was that furnished the wool which the lake dwellers made into their cloth. A close investigation resulted in the decision that these strange people had made felt from the wool of moles. These small animals have a fine fleece which would be out of the question were spinning considered, but could be used for felt.

Felt is a fabric formed without weaving by taking advantage of the tendency of hair and wool to interlace and cling to each other. Antiquarians state that the art of felting was developed long before the weaver was first known. Felting antedates the Christian era by many centuries. Authorities state that the felting quality of hair or wool results from the natural structure of the material. The hair of most animals is noticed to be more or less notched or jagged on its surface. This is the more apparent when an examination of the material is made by the aid of a microscope. In some animals there appears to be a set of barbs on the hair and these barbs are so placed that the tip of each points to the end of the hair. It follows that when a number of hairs are pressed together those which lie in the opposite direction to each other will interlock with the barbs of the hair surface and resist an effort to tear them asunder. When the hair has a natural tendency to curl the interlacing process which is called felting is more easily accomplished. Although the felting property is possessed by wool in a special degree, other animals have it in their covering. This is true of the goat, ox, hare, rabbit and beaver.

J. R. Williams, an American, first introduced a mechanical process for felting in 1820. The main principle involved in Mr. Williams's device and varied in details in other patents that have been taken out is first a carding of the wool into laps of the length and breadth of the web to be made. One layer of these laps is placed upon another to secure the desired thickness of the fabric. The sheet is passed between rollers that are partly immersed in water and may be heated by steam. The material is subjected to a beating and oscillatory motion as well as to pressure.

Government Count of Sheep.

Government reports show that there are to-day more than 67,000,000 sheep in the United States. Some one has calculated that if this number were placed in a column, two abreast, they would circle the globe, and still there would be a few left over. To ascertain the cost of producing this vast amount of wool and mutton, the Government has spent more than a year in investigation. Whenever the tariff occupies the stage in politics and Schedule K is talked about, the question of the cost of producing wool is one of the chief topics. So many conflicting views have been presented on this subject that the Government has employed Prof. E. L. Shaw, a noted sheep expert and corps of assistants to investigate the conditions in the sheep States and to submit a report. Prof. Shaw has been busy since a year ago last October compiling statistics as to the exact cost of sheep raising both in the East and the West. Some idea of the thoroughness of the work can be gathered from the fact that in Helena, Mon., alone, Prof. Shaw and his assistants spent five weeks examining the books of fourteen large sheep ranches.

SAMUEL SLATER, A TEXTILE PIONEER

Came to America in 1789 With His Head Full of Arkwright's New Inventions.

FOUNDER OF AN INDUSTRY

He Built the New Machines Under the Greatest Handicaps and Revolutionized Cotton Spinning.

The history of Samuel Slater, one of the picturesque American pioneers in the textile industry, might be cited as illustrative of the growth of the industry in this country.

The foundation period began with the emigration of the youthful Samuel Slater from England in 1789 and ended with his death in 1835. This may be called the romantic epoch of the business, for the story of Samuel Slater is a remarkable series of accomplishments very rarely found in the life of one man. Apprenticed to Strutt, the associate of the great Arkwright, the lad had mastered Arkwright's inventions which had revolutionized cotton spinning. He had the mechanical instinct and training which permitted him to build the machines himself under what proved to be most adverse conditions. Moreover he knew how the machines should be used for he had a complete working knowledge of textile manufacturing, acquired in a long and thorough apprenticeship.

Before his industrial service with Strutt had ended he had made up his mind to leave England for the New World. He saw further than most men of his day. He believed that the United States presented a greater field for the then modern textile machinery than did England. At that time cotton manufacturing in England was confined to a small section of Derbyshire. The general opinion of those engaged in the business was voiced in an interview between Samuel and his employer.

Before the boy entered into his apprenticeship he asked Mr. Strutt whether he considered it a permanent business. The elder man replied, "It is not probable, Samuel, that it will always be as good as it is now, but I have no doubt it will always be a fair business if it well managed." This was not so conservative an opinion as it appears to one looking back from the present day, for Peel had not then invented the printing cylinder. Naturally the boy was influenced by the prevailing estimate of conditions, and when he read the advertisement of an American society, published in a Philadelphia newspaper, offering a reward for the invention of textile machinery, to accomplish what Arkwright had done, he determined that the United States presented to the inventor who was well grounded in his knowledge a virgin soil which would produce most profitable harvests. Apparently he dared tell no one his plans. Certainly neither his mother nor his brothers learned of his intention until he was on the ocean.

The English Government was guarding its industries with a most jealous care. The sting of the revolution still smarted. No skilled mechanic was permitted to leave the country. No machinery was sold abroad. No person could take passage for the United States without being submitted to a thorough search, and severe punishment awaited one who attempted to smuggle knowledge in a tangible form across the Atlantic.

When he reached America he soon formed the acquaintance of Moses Brown of Providence, who was the founder of Brown University. A year later he was operating the first American machine embodying the Arkwright inventions. Previously some attempts had been made by Americans to build jennies and billies for the spinning of cotton, but none had been successful. The yarns could not be woven into cloth. The power loom had not come into use. Yarns then were woven by hand in households. In 1810, twenty years after Slater's spindles were set to work at Pawtucket, more than a hundred cotton mills were in operation, all constructed after his models.

In the sparse population one of the chief difficulties of the early manufacturers was in procuring operators or help. The mills succeeding Slater's were located further in the interior; on this account Mr. Slater was obliged to seek families and induce them to emigrate to Pawtucket. He found one Arnold with a family of ten or eleven living near a small village in a rude cabin chiefly made of slabs and with a chimney of stone. The roof of this comfortless structure sloped nearly to the ground, but it was the home of these hardy people. Mrs. Arnold appreciated it fully, for when her husband consulted her on the proposed change she insisted that Mr. Slater should give them as good a house as their old one. The wages paid these operators ranged from 80 cents to $1.30 and $1.40 a week.

Pawtucket contained then not more than a dozen houses. There was no school and no church. Mr. Slater introduced the English apprentice system, but it did not suit the American temperament and was abandoned. One lad found the pressure hard and Mr. Slater too strict. He complained to an older companion that he could not stand it. "Very well," said his adviser, "act like the devil and Slater will let you off".

At first Salem was the chief market (the town was then a very important port of export). Hartford was opened next when the supply accumulated and then Philadelphia became the chief market of all. New York or Boston hardly took any of the product. Much was retailed at the mill. The first 13,000 pounds of cotton carded at Pawtucket was picked by hand.

The yarns manufactured at Pawtucket, either in skeins or made up in warps, were sold to farmers and others to be taken to their homes and woven for themselves in hand looms, or were given out to be woven for manufacturers and returned to them in cloth. To obtain this yarn was deemed a favor by the women of the families, as the weaving enabled them to earn the means to pay the merchants for their necessary supplies.

The usual price paid for weaving was four cents a yard for three-fourths yard wide, plain cloth; six cents for four-fourths wide, plain cloth; six cents for three-fourths wide, stripes; eight cents for three-fourths wide, plaids; 10 cents for three-fourths wide, bedticks, and 12½ cents for four-fourths wide, bedticks. This business continued until about 1823.

By 1811 cotton manufaturing had increased to such an extent in Pawtucket and vicinity that it was difficult to find an outlet for all the yarns made, as every family for miles around was employed in the picking and weaving. It became necessary, therefore, to enter a new territory, and especially a farming country, as among the families of the farmers were to be found those skilled in the hand loom process.

In 1815 in response to a public demand Samuel Slater's genius was again put to work, and he erected at Webster the first woollen mill in America, soon to begin the manufacture of uniform cloths. At an early date the United States called upon him to supply this cloth for the army and navy, and to the present day a uniform seen in America can usually trace back its history to the first Slater woollen mill.

Mr. Slater operated the Webster mills almost to the day of his death. From that time they were dominated by the first Horatio N. Slater. He had been taken into the firm by his father in 1829. Six years later he assumed what was substantially the full control of the industry. For nearly forty-five years, until his retirement in 1888, he managed the business, developing it with rapidity and solidity.

Horatio N. Slater was a remarkable man. He had great executive ability. He inherited the mechanical genius of his father and invented improvements to all kinds of machine used in his mills. He built his own looms. He had an instinctive knowledge of fibre, especially of wool, and with it all he had the fine courage and vitality which led to the tremendous expansion of the business.

It was characteristic enterprise that, to rid himself of a transportation monopoly, he built and operated a railroad, the Providence, Webster and Springfield, which is still owned by the estate though operated by the Boston and Albany Railroad as the Webster branch. He was ideally fitted to take up the work where his father had left it and carry it on through the period of vast advance in methods of textile manufacturing. At the same time he had the ability to direct the marketing of a product which in its volume went ahead in leaps and bounds. To this man is due the expansion of the industry, its establishment on staple lines and the formation of the plan which with slight modifications has since been adhered to.

A Big Export Gain of 1911.

Merchandise valued at $2,049,320,199 was exported from this country in 1911, as against $1,744,084,720 a year ago.

GREAT PROGRESS IN THREAD INDUSTRY

The Process of Mercerizing Has Aided in a Marked Degree.

MACHINES ARE INTRICATE

Material Is Passed Back and Forth Through Rollers —Cleaning Important.

Great progress has been made in the development of the mercerizing process for cotton thread and yarns and in adapting the process to the demands of the wholesale trade. It is claimed that the mercerization of fabrics has become one of the world's leading industries, and more especially in the manufacture of hosiery. In the latter industry the mercerized articles have found equal favor with silk, this fact being due to the better wearing qualities of mercerized cotton over the silk hosiery. Mercerized yarns are also being used in the manufacture of underwear as well as in other ways new to the cotton trade.

One of these new uses is in the making of embroidery. Just now embroideries and laces form an important part of milady's wardrobe. The yarns are being used extensively for backing in silks, for mufflers, neckties, scarfs and other articles of a similar nature. For stitching purposes mercerized threads have largely displaced silk not only for home use but in the manufacture of clothing, shoes, hats, gloves, leather goods and other articles where large quantities of stitching threads are used. It would be possible to go on with a much longer list of the uses found for this thread.

Mercerizing gets its name from John Mercer, a Lancashire calico printer who discovered the process in 1844. This consists in treating cotton with certain reagents, such as caustic soda, that results in bringing about chemical changes in the fibre. On placing a piece of bleached calico in caustic soda the experimenters noticed that it changes its appearance and becomes stiff and translucent. When it is washed it appears to go back to its original condition, but close examination discloses the fact that the fabric has shrunk considerably and its texture has taken on a different appearance. It can be dyed more easily and is stronger than an untreated fabric. The microscope shows that the cotton has undergone "morphological changes, inasmuch as the lumen or central cavity is reduced in size while the fibre has lost its characteristic bind shape appearance and becomes rounded."

An important application of the process in calico printing which was devised by Mercer was revived in 1890 and is still much used. Depoully patented another application of this principle in 1884. It has for its object the production of print effects on materials consisting of wool and cotton or silk and cotton. Binding threads are introduced in the manufacture of such goods and then the piece is passed through cold caustic soda, washed, subjected to dilute sulphuric acid and washed again. This process affects the cotton but not the wool or silk and results in the desired puckered effect.

Another application of this process was discovered by H. A. Lowe in 1889 which imparts a permanent lustre to cotton goods. This lustre may be effected in two ways. One is to treat the cotton when it is stretched with strong caustic soda and wash it while it is still stretched. After the washing has been continued for a while it is found that the cotton has acquired a gloss not unlike that of silk. The second method differs only slightly in that the cotton is stretched after its immersion in the caustic bath. Egyptian or Sea Island cotton makes yarns which have the most brilliant lustre. They should be twofold or multifold yarns, because single yarns have been found to be only slightly improved by the process.

The machine for mercerizing cotton yarns consists of two superimposed strong steel rollers on which the hanks of cotton are placed and spread out evenly. The bearings of the upper roller run in a slotted groove. After the soda has been applied the upper roller is revolved and the hanks acting as a belt causes the lower roller to simultaneously move. Three minutes is the time given for this treatment, after which the hanks are washed until their tension slackens and then they are treated with dilute sulphuric acid and waghed again.

Bleaching follows, and the yarn may be subsequently dyed in the ordinary way. Cotton in the piece is mercerized by a more expensive apparatus because it is necessary to prevent contraction in both length and breadth. It has been found that when cotton is mercerized under tension it does not take color so well as when it is mercerized in the slack condition. Why cotton should be made lustrous by this process has not been completely explained by experts and various views have been expressed on the subject.

The thread from which these mercerized fabrics are made is the product of complicated but nearly perfect machinery. The raw material must pass through a maze of rollers, toothed wheels and spindlelike contrivances. As the bales of ginned cotton are received at the mills they are usually dense masses that have been packed by hydraulic pressure. The bale breaker takes these compact bundles and disentagles them. One machine for doing this work consists of three pairs of spiked rollers and one fluted pair, the cotton being fed between the first spiked pair and gripped and pulled apart by the second pair, revolving at a higher velocity. It is then passed to the third pair of spiked rollers, which complete the disentangling process and deliver the cotton to the fluted rollers, by which it is expelled from the machine. A travelling lattice-work conveyor takes the cotton to the mixing room.

To clean the cotton thoroughly it is subjected to the influence of a beater, another machine made up of rollers and teeth. It is passed back and forth from one set of rollers to another until all dirt and impurities pass off through a grating, leaving the cleaned cotton behind. The opened cotton is carried by a strong blast of air and deposited upon the surfaces of two wire cylinders. Foreign matter passes off through the wire netting, the process is repeated two or three times, and finally the cotton, rolled into a sheet, is coiled into a lap.

The next is taken by a machine called a scutcher. This apparatus, not quite as plentifully supplied with rollers as the previous ones, finishes up whatever cleaning has not been done by the others and makes the laps of equal weight and density for delivery to the carding machine.

The cotton fibres are arranged parallel and formed into a porous band called a sliver by the carding machine. Three cylinders work together in this machine. The first, or takerin, is covered with saw teeth. The teeth comb the attached fibres, delivering the loose ones to the main cylinder, where the combing is carried on by means of several small cylinders. Thus the cotton is passed around and back and forth until all of the fibres are neatly arranged in the proper position to be fed into a funnel, which forms them into the sliver and deposits them in a can. Finer grades of cotton are handled by the combing machine, which turns out a product similar to that of the carding machine.

A drawing frame takes charge of the slivers, and by its rollers attenuates the fibres, eliminating irregularities and evening them. The first twisting of the slivers is done by the flier frame, which also winds the cotton up on wooden spools. Next there comes the intermediate frame to carry along the processes of combination, attenuation, twisting and winding, and these manipulations come to an end in the roving frame, which turns out the finished thread.

Although the roving frame is usually the last one in the process of thread-making for spinning, where fine yarns like those made from Egyptian and Sea Island are to be spun a second roving machine is sometimes employed. This one is called a jack frame. It takes the pairs of rovings from the roving frame and twists them still closer, in order that the final product may be fine enough for the use to which it is to be put.